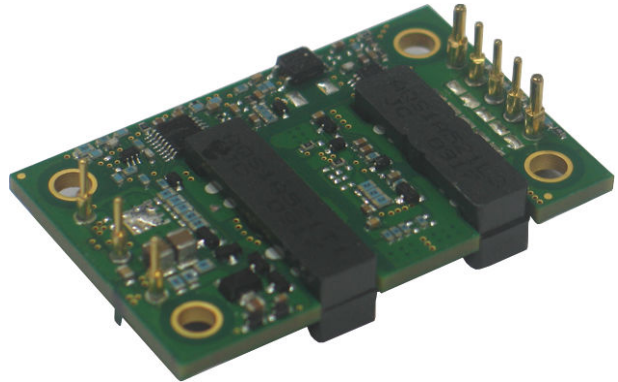


## Description

The AVQ100-24S05 is a single output DC-DC converter with standard quarter-brick outline and pin configuration. It delivers up to 20A output current with 5V output voltage. Above 93% ultra-high efficiency and excellent thermal performance makes it an ideal choice in telecom and datacom application.



## Operational Features

- Delivers up to 20A output current
- Ultra-high efficiency 93% typ. at half load
- Wide input range: 18V ~36V
- Basic isolation
- Low output noise
- Excellent thermal performance
- No minimum load requirement
- Zero output capacitance
- RoHS 6 compliant

## Control Features

- Remote control function (negative or positive logic optional)
- Remote output sense
- Trim function: 80% ~ 110%

## Protection Features

- Input under voltage lockout
- Output over current protection
- Output over voltage protection
- Over temperature protection

## Mechanical Features

- Industry standard quarter-brick pin-out outline
- Open frame
- Pin length option: 4.8mm

## Safety & EMC

- Meets safety standards UL 60950-1, CSA-C22.2 NO. 60950-1, IEC/EN 60950-1 and GB4943.
- Approved by UL and TUV.
- Meets 2006/95/EEC and 93/68/EEC directives which facilitates CE marking in user's end product
- Meets conducted emission's requirements of FCC Class A and EN55022 Class A with external filter.

## Electrical Characteristics

Full operating ambient temperature range is -40°C to +85°C.

Specifications are subject to change without notice.

| Parameter                                  |                            | Min. | Typ.    | Max. | Unit             | Notes & Conditions                             |
|--------------------------------------------|----------------------------|------|---------|------|------------------|------------------------------------------------|
| <b>Absolute max. ratings</b>               |                            |      |         |      |                  |                                                |
| Input voltage                              | Non-operating              | 0    |         | 50   | V                | 100ms                                          |
|                                            | Operating                  | 0    |         | 40   | V                | Continuous                                     |
| Operating temperature                      |                            | -40  |         | 85   | °C               |                                                |
| Storage temperature                        |                            | -55  |         | 125  | °C               |                                                |
| Voltage at remote ON/OFF pin               |                            | -0.7 |         | 12   | V                |                                                |
| <b>Input characteristics</b>               |                            |      |         |      |                  |                                                |
| Operating input voltage range              |                            | 18   | 24      | 36   | V                |                                                |
| Input under-voltage lockout                | Turn-on voltage threshold  | 15   | 17      | 18   | V                |                                                |
|                                            | Turn-off voltage threshold | 14   | 16      | 17   | V                |                                                |
|                                            | Lockout voltage hysteresis | 1    |         | 3    | V                |                                                |
| Max. input current                         |                            |      |         | 6.3  | A                | Vin=0-Vinmax<br>Iout=Iomax                     |
| No-load input current                      |                            |      |         | 0.2  | A                |                                                |
| Standby Input current                      |                            |      | 0.01    | 0.1  | A                | Remote OFF                                     |
| Inrush current transient rating            |                            |      | 0.2     | 1    | A <sup>2</sup> s | Figure 14                                      |
| Input reflected ripple current             |                            |      | 20      | 50   | mA               | Figure 3<br>Through 12μH inductor; Figure 14   |
| Recommended input fuse                     |                            |      |         | 15   | A                | Fast blow external fuse recommended; Figure 10 |
| Input filter component values (C/L)        |                            |      | 6.6\2.2 |      | μF\μH            | Internal values                                |
| Recommended external input capacitance     |                            |      | 220     |      | μF               | Low ESR capacitor recommended; Figure 10       |
| <b>Output characteristics</b>              |                            |      |         |      |                  |                                                |
| Output voltage set point (standard option) |                            | 4.95 | 5       | 5.05 | V                | 48Vin, full load                               |
| Output voltage line regulation             |                            |      | 0.2     |      | %                |                                                |
|                                            |                            |      | 1       |      | mV               |                                                |

| Parameter                             |                                          | Min. | Typ. | Max. | Unit    | Notes & Conditions                                                     |
|---------------------------------------|------------------------------------------|------|------|------|---------|------------------------------------------------------------------------|
| Output voltage load regulation        |                                          |      | 0.2  |      | %       |                                                                        |
|                                       |                                          |      | 1    |      | mV      |                                                                        |
| Output voltage temperature regulation |                                          |      | 0.02 |      | %/°C    |                                                                        |
| Total output voltage range            |                                          | 4.85 | 5    | 5.15 | V       | Over sample, line, load, temperature & life                            |
| Output voltage ripple and noise       |                                          |      | 20   | 140  | mVpp    | Figure 2<br>20MHz bandwidth; Figure 14                                 |
| Operating output current range        |                                          | 0    |      | 20   | A       |                                                                        |
| Output DC current-limit inception     |                                          | 22   |      | 28   | A       | Hiccup: auto-restart when over-current condition is removed            |
| Output capacitance                    |                                          | 0    | 470  | 5000 | μF      | High frequency and low ESR is recommended                              |
| Dynamic characteristics               |                                          |      |      |      |         |                                                                        |
| Dynamic response                      | 50% ~ 75% ~ 50%<br>$I_{o,max}$ , 0.1A/μs |      | 85   |      | mV      | Figure 4<br>Test condition: 25°C, nominal input voltage, see Figure 10 |
|                                       | Settling time                            |      | 50   |      | μs      | Recovery to within 1% $V_{o,nom}$                                      |
|                                       | 50% ~ 75% ~ 50%<br>$I_{o,max}$ , 1A/μs   |      | 95   |      | mV      | Figure 5<br>Test condition: 25°C, nominal input voltage, see Figure 10 |
|                                       | Settling time                            |      | 80   |      | μs      | Recovery to within 1% $V_{o,nom}$                                      |
| Turn-on transient                     | Rise time                                |      | 8    | 30   | ms      | Full load, Figure 6                                                    |
|                                       | Turn-on delay time                       |      | 4    | 30   | ms      | Figure 6                                                               |
|                                       | Output voltage overshoot                 |      | 0    |      | % $V_o$ | Figure 6                                                               |
| Efficiency                            |                                          |      |      |      |         |                                                                        |
| 100% load                             |                                          |      | 92.5 |      | %       | Figure 1                                                               |
| 50% load                              |                                          |      | 93   |      | %       | Figure 1                                                               |

## Electrical Characteristics (Continued)

| Parameter                                                           |                   | Min. | Typ. | Max. | Unit              | Notes & Conditions                                                     |
|---------------------------------------------------------------------|-------------------|------|------|------|-------------------|------------------------------------------------------------------------|
| <b>Isolation characteristics</b>                                    |                   |      |      |      |                   |                                                                        |
| Isolation voltage (conditions: 1mA for 60s, slew rate of 1500V/10s) |                   | 1500 |      |      | V                 | Basic insulation, pollution degree 2, input to output                  |
| <b>Feature characteristics</b>                                      |                   |      |      |      |                   |                                                                        |
| Switching frequency                                                 |                   |      | 310  |      | kHz               |                                                                        |
| Remote ON/OFF control (positive logic)                              | Off-state voltage | -0.7 |      | 1.2  | V                 | See Figure 11                                                          |
|                                                                     | On-state voltage  | 3.5  |      | 12   | V                 |                                                                        |
| Remote ON/OFF control (negative logic)                              | Off-state voltage | 3.5  |      | 12   | V                 |                                                                        |
|                                                                     | On-state voltage  | -0.7 |      | 1.2  | V                 |                                                                        |
| Output voltage trim range                                           |                   | 4    |      | 5.5  | V                 | See <i>Trim Characteristics</i> of <i>Application Note</i>             |
| Output voltage remote sense range                                   |                   |      |      | 0.25 | V                 |                                                                        |
| Output over-voltage protection                                      |                   | 120  | 130  | 150  | %Vo,nom           | Hiccup: auto-restart when over-voltage condition is removed            |
| Over-temperature shutdown                                           |                   |      | 125  |      | °C                | Auto recovery; over-temperature protect(OTP) test point: see Figure 16 |
| Over-temperature hysteresis                                         |                   | 5    | 10   |      | °C                |                                                                        |
| <b>Reliability characteristics</b>                                  |                   |      |      |      |                   |                                                                        |
| Calculated MTBF (telcordia)                                         |                   |      | 2.5  |      | 10 <sup>6</sup> h | Telcordia SR-332-2006; 80% load, 300LFM, 40°C T <sub>a</sub>           |

## Electromagnetic compatibility requirements

| Test Item                                                               | Regulations                                                                           | Criteria | Notes & Conditions      |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|-------------------------|
| Conducted Emission                                                      | EN 55022<br>DC input port, Class A/B Limits                                           | A        | See EMC test conditions |
| Immunity to Electrostatic Discharge                                     | IEC/EN61000-4-2<br>Enclosure Port, Level 3                                            | B        |                         |
| Immunity to Electrical Fast Transient                                   | IEC/EN61000-4-4<br>DC input port, Level 3                                             | B        |                         |
| Immunity to Surges                                                      | IEC/EN61000-4-5<br>DC input port<br>Line to Ground(earth): 600V<br>Line to Line: 600V | B        |                         |
| Immunity to Continuous Conducted Interference                           | IEC/EN61000-4-6<br>DC input port, Level 2                                             | A        |                         |
| Immunity To Voltage Dips and short interruptions and voltage variations | EN 61000-4-29<br>DC input port                                                        | B        |                         |

Criterion A: Normal performance during and after test.

Criterion B: For EFT and surges, low-voltage protection or reset is not allowed. Temporary output voltage fluctuation ceases after disturbances ceases, and from which the EUT recovers its normal performance automatically. For Dips and ESD, output voltage fluctuation or reset is allowed during the test, but recovers to its normal performance automatically after the disturbance ceases.

Criterion C: Temporary loss of output, the correction of which requires operator intervention.

Criterion D: Loss of output which is not recoverable, owing to damage to hardware.

## Qualification Testing

| Parameter        | Unit (pcs) | Test condition                                                                                                                        |
|------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Halt test        | 4 ~ 5      | $T_{a,min} - 10^{\circ}\text{C}$ to $T_{a,max} + 10^{\circ}\text{C}$ , $5^{\circ}\text{C}$ step, $V_{in}$ = min to max, 0 ~ 105% load |
| Vibration        | 3          | Frequency range: 5Hz ~ 20Hz, 20Hz ~ 200Hz, A.S.D: $1.0\text{m}^2/\text{s}^3$ , -3db/oct, axes of vibration: X/Y/Z<br>Time: 30min/axis |
| Mechanical shock | 3          | 30g, 6ms, 3axes, 6directions, 3time/direction                                                                                         |
| Thermal shock    | 3          | $-40^{\circ}\text{C}$ to $100^{\circ}\text{C}$ , unit temperature 20cycles                                                            |
| Thermal cycling  | 3          | $-40^{\circ}\text{C}$ to $55^{\circ}\text{C}$ , temperature change rate: $1^{\circ}\text{C}/\text{min}$ , cycles: 2cycles             |
| Humidity         | 3          | $40^{\circ}\text{C}$ , 95%RH, 48h                                                                                                     |
| Solder ability   | 15         | IPC J-STD-002C-2007                                                                                                                   |

## Characteristic Curves

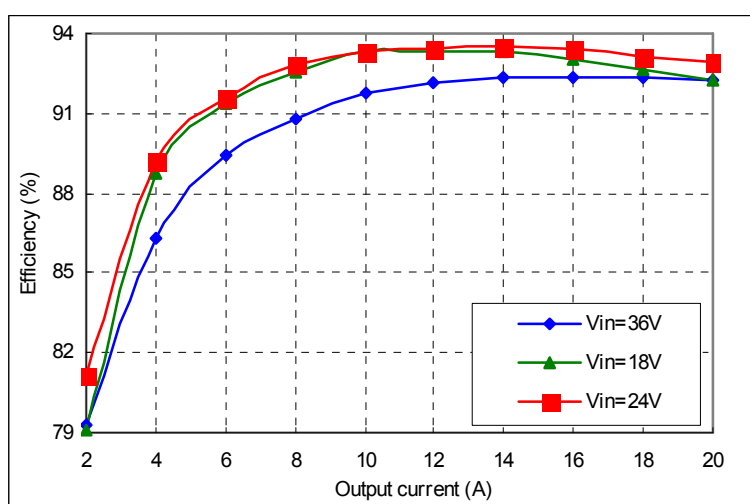


Figure 1 Efficiency vs. output current,  $T_a=25^{\circ}\text{C}$ ,  $V_o=5\text{V}$

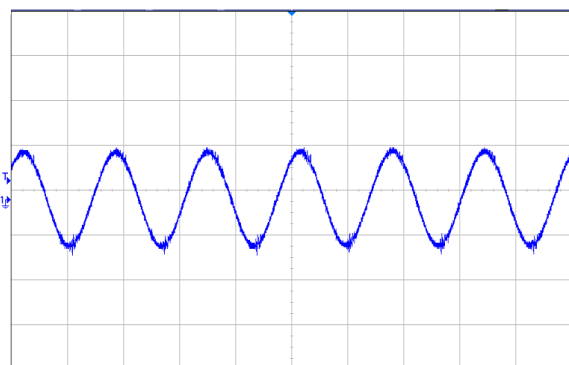


Figure 2 Output ripple & noise (2 $\mu\text{s}/\text{div}$ , 5mV/div), see Figure 14 for test configuration

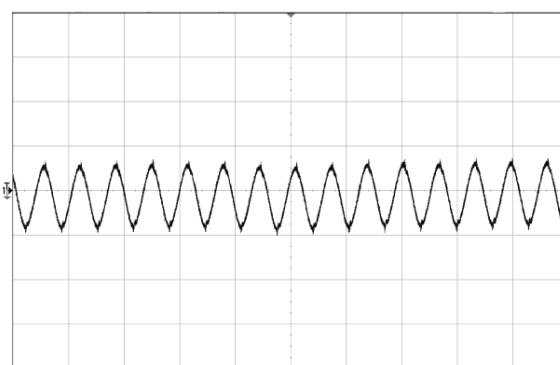


Figure 3 Input reflected ripple current (5 $\mu\text{s}/\text{div}$ , 10mA/div), see Figure 14 for test configuration

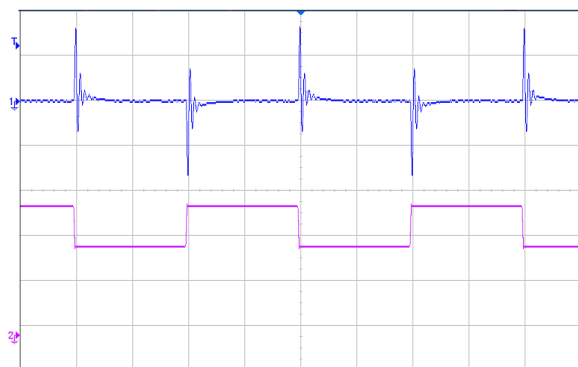


Figure 4 Dynamic response for 25% load step (50% ~ 75% ~ 50%) and 0.1A/μs slew rate, (2ms/div), see Figure 10 for test configuration; CH1-output voltage (50mv/div); CH2- output current (5A/div)

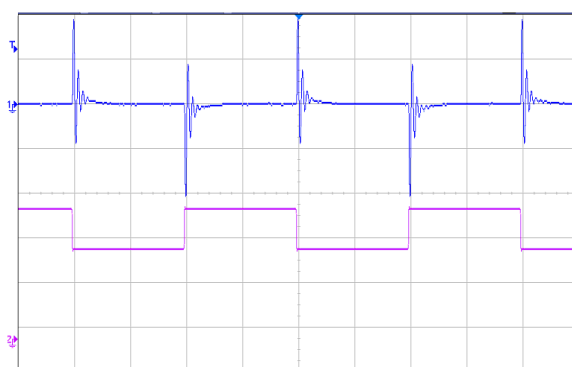


Figure 5 Dynamic response for 25% load step (50% ~ 75% ~ 50%) and 1A/μs slew rate, (2ms/div), see Figure 10 for test configuration; CH1-output voltage (50mv/div); CH2- output current (5A/div)

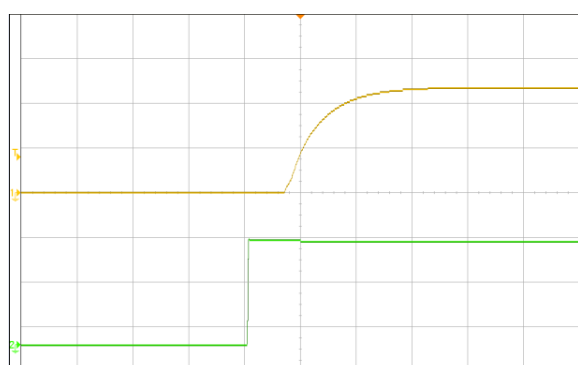


Figure 6 Output voltage startup by power on, (5ms/div), see Figure 10 for test configuration; CH1-output voltage (2V/div); CH2-input voltage (10V/div)

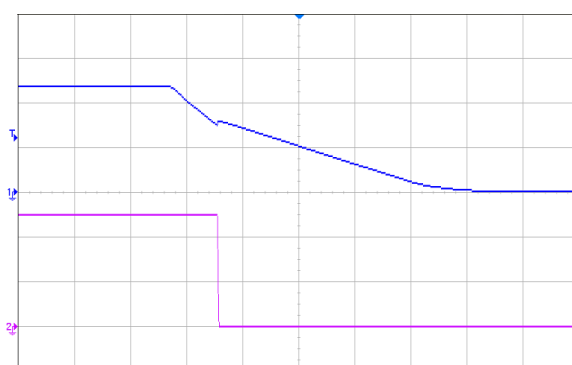


Figure 7 Output voltage shut down by power off, (10ms/div), see Figure 10 for test configuration; CH1-input voltage (10V/div); CH2-output voltage (2V/div)

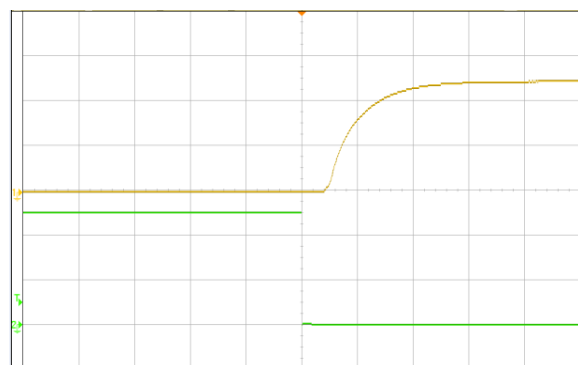


Figure 8 Output voltage startup by remote ON, (5ms/div), see Figure 10 for test configuration; CH1-output voltage (2V/div); CH2-remote ON (2V/div)

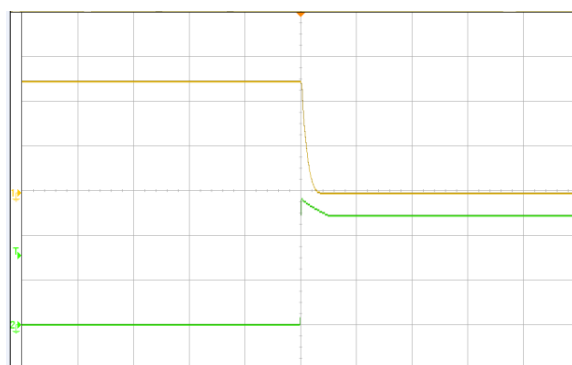


Figure 9 Output voltage shutdown by remote OFF, (500μs/div), see Figure 10 for test configuration; CH1-output voltage (2V/div); CH2-remote OFF voltage (2V/div)

## Application Note

### Typical Application

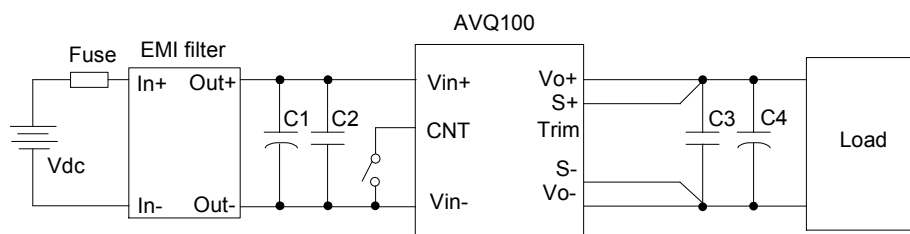


Figure 10 Typical application

C1: 220 $\mu$ F/50V electrolytic capacitor, P/N: UPM1H221MPD (Nichicon) or equivalent caps.

C2, C3: 1 $\mu$ F/100V X7R ceramic capacitor, P/N: C3225X7R2A105KT0L0U (TDK) or equivalent caps

C4: 470 $\mu$ F/25V electrolytic capacitor, P/N: UPM1E471MHD (Nichicon) or equivalent caps.

Note: If ambient temperature is below -5°C, an additional 220 $\mu$ F tantalum capacitor (Low ESR, ESR  $\leq$  100m $\Omega$ ) is needed for output.

Fuse: External fast blow fuse with a rating of 15A. The recommended fuse model is 216015.P from LITTLEFUSE.

### Remote ON/OFF

Either positive or negative remote ON/OFF logic is available in AVQ100-24S05. The logic is CMOS and TTL compatible.

Figure 11 is the detailed internal circuit and reference in AVQ100-24S05.

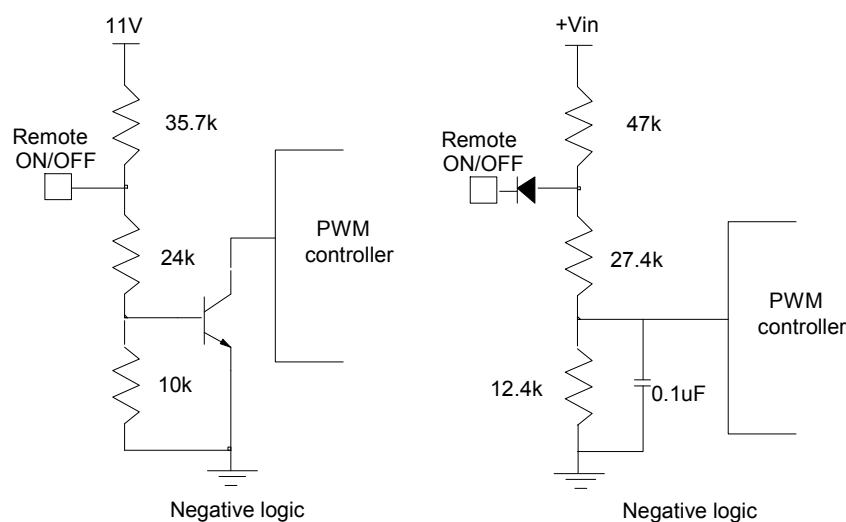


Figure 11 Remote ON/OFF internal diagram

## Trim Characteristics

Connecting an external resistor between Trim pin and  $V_o^-$  pin will decrease the output voltage. While connecting it between Trim and  $V_o^+$  will increase the output voltage. The following equations determine the external resistance to obtain the trimmed output voltage.

$$R_{adj\_down} = \left( \frac{510}{\Delta} - 10.2 \right) k\Omega$$

$$R_{adj\_up} = \left( \frac{5.1 \times V_o (100 + \Delta)}{1.225 \times \Delta} - \frac{510}{\Delta} - 10.2 \right) k\Omega$$

$\Delta$ : Output error rate against nominal output voltage.

$$\Delta = \frac{V_{nom} - V_o}{V_{nom}} \times 100$$

$V_{nom}$ : Nominal output voltage.

$V_o$ : Desired output voltage.

For example, to get 5.5V (+10%) output, the trimming resistor is

$$\Delta = \frac{5.5 - 5}{5} \times 100 = 10$$

$$R_{adj\_up} = \left( \frac{5.1 \times 5 \times (100 + 10)}{1.225 \times 10} - \frac{510}{10} - 10.2 \right) k\Omega = 167.8 k\Omega$$

The output voltage can also be trimmed by potential applied at the Trim pin.

$$V_o = (V_{trim} + 1.225) \times 2.04$$

Where  $V_{trim}$  is the potential applied at the Trim pin, and  $V_o$  is the desired output voltage.

When trimming up, the output current should be decreased accordingly so as not to exceed the maximum output power.

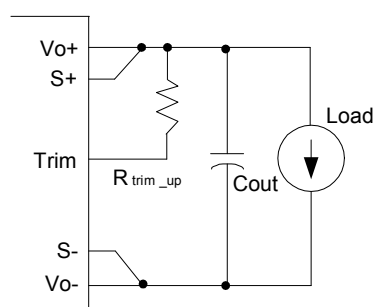


Figure 12 Trim up

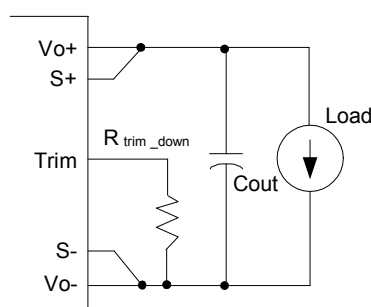


Figure 13 Trim down

## Sense Characteristics

If the load is far from the unit, connect S+ and S- to the terminal of the load respectively to compensate the voltage drop on the transmission line. See Figure 10.

If the sense compensate function is not necessary, connect S+ to  $V_o^+$  and S- to  $V_o^-$  directly.

## Input Ripple & Inrush Current And Output Ripple & Noise Test Configuration

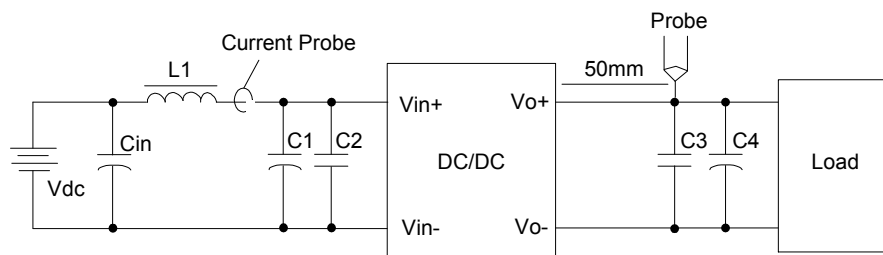


Figure 14 Input ripple & inrush current, ripple & noise test configuration

Vdc: DC power supply

L1: 12 $\mu$ H

Cin: 220 $\mu$ F/100V typical

C1 ~ C4: See Figure 10

Note: Using a coaxial cable with series 50 $\Omega$  resistor and 0.68 $\mu$ F ceramic capacitor or a ground ring of probe to test output ripple & noise is recommended.

## EMC test conditions

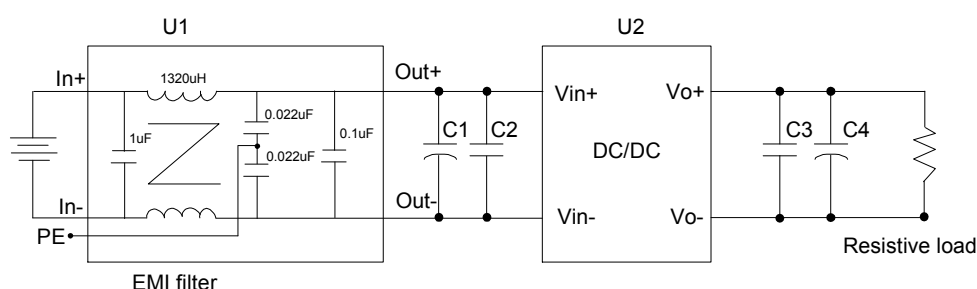


Figure 15 EMC test configuration

U1: Input EMC filter.

U2: Module to test, AVQ100-24S05.

C1 ~ C4: See Figure 10.

## Thermal Considerations

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. Proper cooling can be verified by measuring the temperature at test points P1, P2. The temperatures at these points should not exceed the max values in Table 1.

For a typical application, Figure 17 shows the derating of output current vs. ambient air temperature at different air velocity.

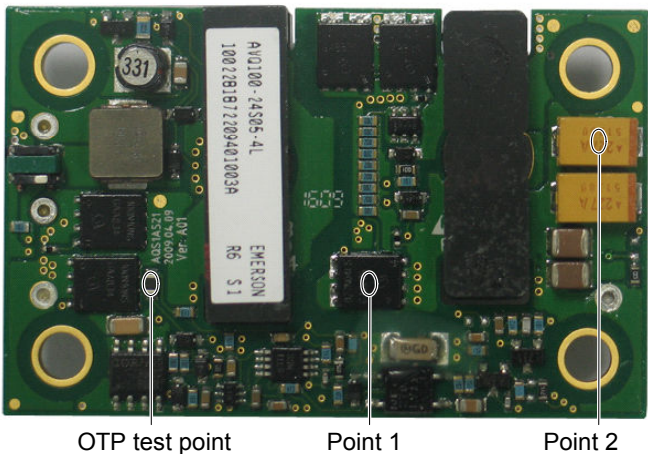


Figure 16 Thermal test points

Table 1 Temperature limits

| Test Point     | Temperature limit |
|----------------|-------------------|
| OTP Test Point | 120°C             |
| P1             | 120°C             |
| P2             | 110°C             |

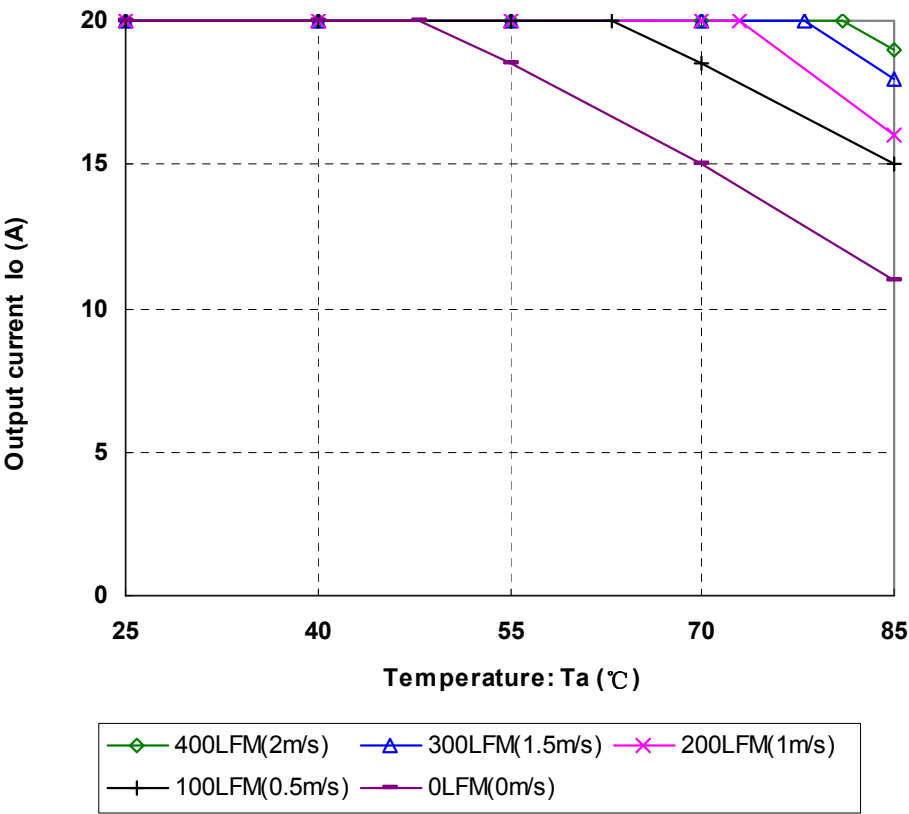


Figure 17 Output power derating, 24V<sub>in</sub>, air flowing across the converter from pin 3 to pin 1

## Thermal image

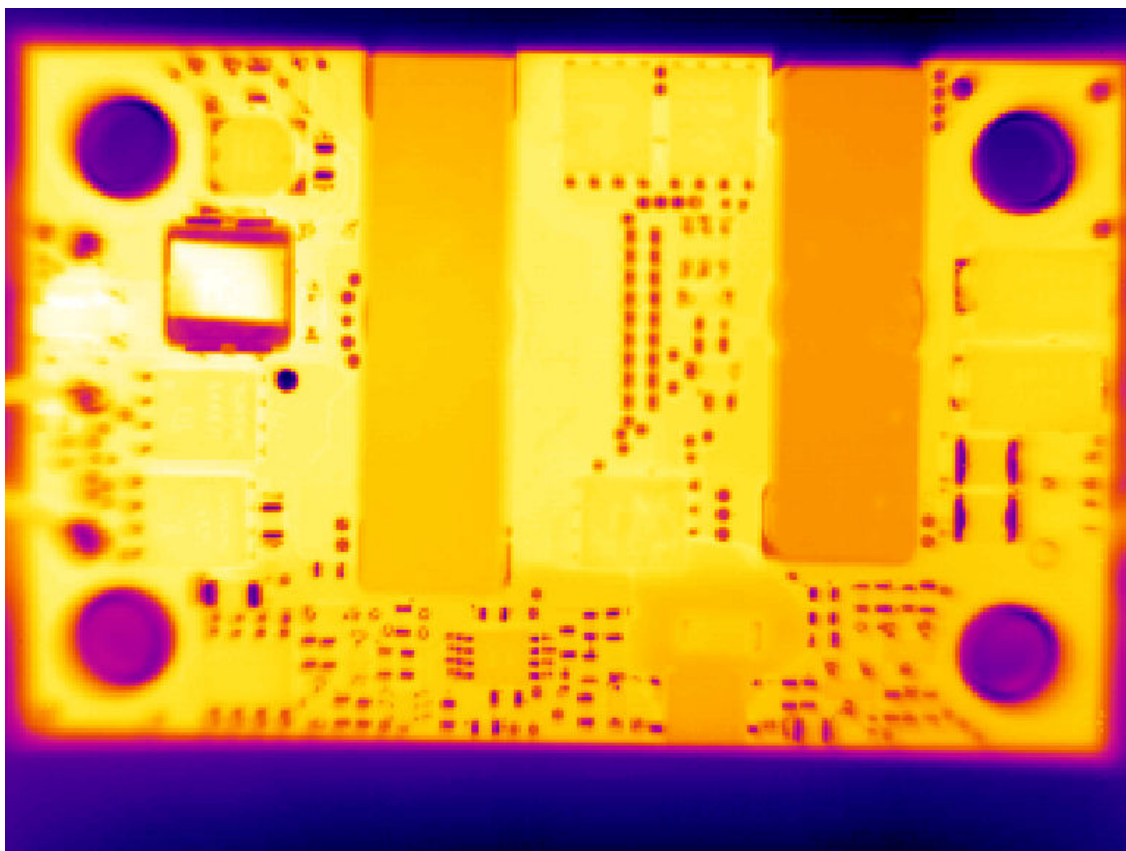
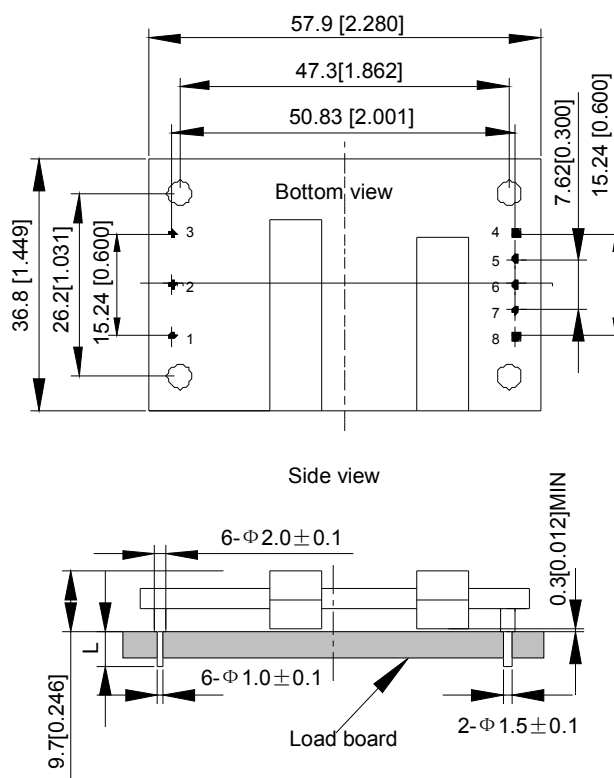


Figure 18 Thermal image, 24V<sub>in</sub>, 5V<sub>o</sub>, full load, room temperature, 200 LFM (air flowing from pin 3 to pin 1)

## Mechanical Diagram



Unit: mm[inch]

Bottom view: pin on upside

Tolerance: X.Xmm ± 0.5mm[X.X in. ± 0.02in.]

X.XXmm ± 0.25mm[X.XX in. ± 0.01in.]

Figure 19 Mechanical diagram

## Pin length option

| Device code suffix | L           |
|--------------------|-------------|
| -4                 | 4.8mm±0.2mm |
| -6                 | 3.8mm±0.2mm |
| -8                 | 2.8mm±0.2mm |
| None               | 5.8mm±0.2mm |

## Pin Designations

| Pin NO. | Name          | Function                |
|---------|---------------|-------------------------|
| 1       | $V_{in+}$     | Positive input voltage  |
| 2       | Remote ON/OFF | Remote control          |
| 3       | $V_{in-}$     | Negative input voltage  |
| 4       | $V_{o-}$      | Negative output voltage |
| 5       | S-            | Negative remote sense   |
| 6       | Trim          | Output voltage trim     |
| 7       | S+            | Positive remote sense   |
| 8       | $V_{o+}$      | Positive output voltage |

## Soldering

The product is intended for standard manual or wave soldering.

When wave soldering is used, the temperature on pins is specified to maximum 260°C for maximum 7s.

When soldering by hand, the iron temperature should be maintained at 300°C ~ 380°C and applied to the converter pins for less than 10s. Longer exposure can cause internal damage to the converter.

Cleaning of solder joint can be performed with cleaning solvent IPA or similitive.

## Ordering Information

| AVQ100 | - | 24 | S | 05 | P | B | - | 4 | L |
|--------|---|----|---|----|---|---|---|---|---|
| ①      |   | ②  | ③ | ④  | ⑤ | ⑥ |   | ⑦ | ⑧ |

|   |                      |                                                                   |
|---|----------------------|-------------------------------------------------------------------|
| ① | Model series         | AVQ: high efficiency quarter brick series, 100: output power 100W |
| ② | Input voltage        | 24: 18V ~ 36V input range, rated input voltage 24V                |
| ③ | Output number        | S: single output                                                  |
| ④ | Rated output voltage | 05: 5V output                                                     |
| ⑤ | Remote ON/OFF logic  | Default: negative; P: positive logic                              |
| ⑥ | Baseplated           | Default: no baseplated ; B: baseplated                            |
| ⑦ | Pin length           | -4: 4.8mm                                                         |
| ⑧ | RoHS status          | L: RoHS, R6; Y: RoHS, R5                                          |

| Model number      | Description                                                                                                                                                                          |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AVQ100-24S05-4L   | 4.8mm pin length; negative on/off logic; open frame; R6 compliant                                                                                                                    |
| AVQ100-24S05P-4L  | 4.8mm pin length; positive on/off logic; open frame; R6 compliant                                                                                                                    |
| AVQ100-24S05B-4L  | 4.8mm pin length; negative on/off logic;with baseplated;without thread inside mounting hole; R6 compliant; for detailed information,refer to AVQ100-24S05B Technical Reference Notes |
| AVQ100-24S05PB-4L | 4.8mm pin length; positive on/off logic;with baseplated;without thread inside mounting hole; R6 compliant; for detailed information,refer to AVQ100-24S05B Technical Reference Notes |

## Hazardous Substances Announcement (RoHS Of China)

| Parts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Hazardous substances |    |    |                  |     |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----|----|------------------|-----|------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Pb                   | Hg | Cd | Cr <sup>6+</sup> | PBB | PBDE |
| AVQ100-24S05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ○                    | ○  | ○  | ○                | ○   | ○    |
| <p>○: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006</p> <p>√/: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006</p> <p>Emerson Network Power Co., Ltd. has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:</p> <ol style="list-style-type: none"> <li>1. Solders (including high-temperature solder in parts) contain plumbum.</li> <li>2. Glass of electric parts contains plumbum.</li> <li>3. Copper alloy of pins contains plumbum</li> </ol> |                      |    |    |                  |     |      |

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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